The story is fascinatingly told but with such a preliminary skimming of the realm of science in the earlier grades the student may find the hard work of the rigorous analysis of the principles of physics less exciting as he meets them later on.

Physics for Modern Times. This text, which was first published in 1952, represents the outcome of an attempt to develop a physics program for high school students who are not going to continue their formal education. It is basically concerned with the "concrete objects of the student's environment, not the abstractions," and represents a wealth of essentially technological information.

The book is weakest in its general theoretical explanations, and strongest in its explicit treatment of various machines, instruments and devices. The weaknesses are apparent. The author could not really mean (p. 13) that 1800 protons placed side by side would equal the diameter of an electron. He is obscure again on p. 38 when he states that a rock released from a whirling string would fly off in a straight line "away from you." One hopes that he does not mean *radially* away from you.

It is interesting to read a book which stands out in stark relief from texts which develop material in a more general and fundamental way. All the pulleys, levers, engines and machines which have been removed from such texts here are bound in one volume! There is even a picture of a pulley on the cover!

The chapters on transportation go from the oxcart via covered wagon to iron horse and horseless carriage by land and from floating log via rowboat and paddle wheel steamer to screw driven ships by sea. The submarine, the balloon, the airplane and the elevator are included. But should not ships propelled by nuclear reactors be included in a *Physics for Modern Times*?

One's first inclination might be to ignore such an obvious throwback to the bad old days, but after a little reflection one also recognizes that a book like this might be interesting to the student who is not reached by any of the present courses. A careful teacher who is willing to take the time to correct some of the misinterpretations could use various sections in a general science or physical science course, or perhaps in an industrial arts course. The lack of mathematics and the descriptive questions are appropriate for many students who are bored by abstraction and generalization. These students will never resent being told that absolute zero means no molecular motion. Any teacher who is interested in a course for students that are primarily interested in things and how they work should look at this book. The lack of pretentiousness, the pleasant style and good diagrams all might contribute to its potential usefulness in some specific learning situations.

This team of reviewers realizes the difficulties of textbook writing. Authors do not always have complete freedom of action. We learned that one state legislature requires a glossary in any adopted textbook of physics. Perhaps this accounts for the lack of precision in the definitions that occur there. A publisher may not wish a whole-hearted revision of a text that has been a good seller. Therefore, some texts outlive their usefulness. The individual author obviously is at a disadvantage in competing with team efforts. Yet few have attempted to cut coverage and introduce radical methods of approach. Perhaps the reviewers have been too polite in pointing out errors. May we suggest that every user of a textbook whenever he finds a mistake or an ambiguity write a friendly note to publisher and author. In conclusion, we again praise the authors' energy and courage. May their royalties repay their efforts.

Introduction to Semiconductor Physics. R. B. Adler, A. C. Smith and R. L. Longini. John Wiley and Sons, Inc., New York, 1964. Pp. xii + 245. Price $4.50 clothbound, $2.65 paperbound.

Physical Electronics and Circuit Models of Transistors. P. E. Gray, D. DeWitt, A. R. Boothroyd and J. F. Gibbons. John Wiley and Sons, Inc., New York, 1964. Pp. 262 + xx. Price $4.50 clothbound, $2.65 paperbound.

Reviewed by: R. E. Alley, Jr.
U. S. Naval Academy
Annapolis, Maryland

These are the first two of a seven-volume series. Designed for use in a college course in semiconductor electronics, they were prepared under the auspices of the Semiconductor Electronics Education Committee, a group consisting of representatives from university faculties and from industry. All volumes will have the same price and will have approximately the same length. All are scheduled for publication before December, 1965.

Without becoming mired in mathematics and quantum theory, the authors of volume I develop the basic concepts required for an understanding of the mechanism of conduction in intrinsic and doped semiconductors. Quantitative approaches are followed where possible and qualitative discussions are introduced as required to provide insight into semiconductor behavior. In volume II, the characteristics of the p-n junction and of the junction transistor are developed on the basis of the material presented in volume I. Circuit models for small signal applications and for transient operation of transistors are derived. The relationship between the physics of the transistor and its characteristics as a circuit device are made clear. Circuit applications are reserved for treatment in another volume.

For the physics teacher, these volumes are interesting as the basis for a self-teaching program in semiconductors. Attention is focussed upon essential ideas, and the presentations are concise and lucid. For one who is familiar with the calculus and with the modern physics which is offered in an up-to-date introductory physics course, and who is prepared to work, they provide an excellent means toward gaining an understanding, as contrasted with a superficial knowledge, of transistor theory and circuit characteristics.

Michael Faraday. A Biography. L. Pearce Williams. Basic Books, New York, 1965. Pp. xvi + 531. Illustrated. Price $12.50.

Reviewed by: Melba Phillips
University of Chicago
Chicago, Illinois

Faraday is generally recognized as the greatest experimental physicist of the 19th century, perhaps of all time, but this comprehensive new biography emphasizes the role of contemporary theory on his work. As a consequence the science is often not readily understandable, although Professor Williams' style is highly readable. The reasons are obvious. Faraday's great experiments are *our* experiments: we demonstrate the fundamental empiri-

cal laws and exhibit electromagnetic properties of matter by repeating them very much as they were originally performed. Faraday's theory is *not* our theory: from him we inherited the beginnings of field theory, but the controversy over point atoms versus contiguous atoms is to us archaic and unenlightening. Williams' admittedly conjectured reconstruction of Faraday's thought processes purportedly anticipating the transient nature of the induced current in electromagnetic induction is not altogether convincing. The story is even a little pompous, for it seems to imply that Faraday was unique in this great discovery. The motivation of Joseph Henry and of Emil Lenz would be equally interesting, possibly more so, but this is of course a biography of Faraday and not a history of electromagnetism.

Yet because of careful scholarship, fresh evidence including hitherto unpublished sources, skillful organization and excellent writing, this new book on Faraday is an outstanding contribution to the history of science. It begins with the ancestry of the Faraday family in Yorkshire and the origins of the Sandemanian religion to which Michael Faraday was devoted throughout his life. James Faraday was a blacksmith who moved his small family to London before Michael was born in 1791. There was little opportunity for formal education, and Michael Faraday was apprenticed to a bookbinder in 1805, after working as errand boy. There were opportunities for continuing self education, and during the winter of 1812-1813 Faraday secured a position as helper at the Royal Institution after presenting to Sir Humphrey Davy a bound volume of the notes he had taken of Davy's lectures. By 1820 he was earning money as a consultant chemist, adding to his salary of 30 shillings per week. In 1821 he was married but he and his wife Sarah had no children.

Most of the present book is devoted to Faraday's work in electricity and magnetism. His personal life is related with great sympathy and understanding, yet it seems curiously thin. Faraday was a Tory who could not understand how passions could be aroused by such issues as slavery in the United States. He wrote John Tyndall "When science is a republic, then it gains; and though I am no republican in other matters, I am in that." Yet he took very little part in scientific organizations. Perhaps he was able to make his great scientific achievement only because he withdrew from the world as completely as possible. The role of Faraday's discoveries in technology and thus in industrial economy became fully apparent only after his death. The "Epilogue" of Professor Williams' book is devoted to vindication of his theoretical ideas in the hands of others, primarily Maxwell, but there is little or no mention of the practical application of many of Faraday's discoveries.

Exploring the Physical Sciences. Willard J. Poppy and Leland L. Wilson. Prentice-Hall, Inc., Publishers, Englewood Cliffs, N. J., 1965. Pp. VIII + 376. Illustrated. Price $6.95.

Reviewed by: Edmund C. Bray
University of Minnesota
Minneapolis, Minnesota

For many years, this reviewer has been interested in the integration of the physical sciences, feeling that it was important to stress the unity of science rather than the artificial boundaries which have evolved over the years. Each new volume in the field is opened with interest to find what it contributes.

Poppy and Wilson base their book on material used in a one-semester physical science course at the State College of Iowa. To attempt to give even an introduction to the subject in one semester places definite limits on what can be done. In this text the authors choose to limit their treatment to three areas: space, energy, and the structure of matter. These they claim are logically related and have quite smooth transition between them. This probably is as true as it can be in an attempt to cover so many things even within these limits. What is presented is stated carefully and generally correctly, though brevity at times leads to questionable implications.

The difficulty with the treatment is that only a page or even a paragraph can be devoted to a subject. The result consequently becomes hardly more than a book of scientific facts arranged in a sequential order. These facts range from "the Dawn of Science" to "Public Understanding of Science." Between these two sections are crowded too many things. Biographies of scientists and inventors, from Thales through Hahn and Strassman, are so brief that they become little more than a list of names and contributions. The unit entitled EARTH AND SKY includes discussions of time, the earth, the moon, the planets, the sun and stars with more space devoted to "A Trip to the Moon" than to more important scientific subjects. The unit ENERGY ranges from force and motion through heat and electrical energy with the surprising omission of any mention of light and wave phenomena. Somewhat more than a third of the book is devoted to the unit MATTER AND CHANGE so the treatment of the chemical aspect is somewhat better than the other presentations. Yet, here too, there is the attempt to do too much in ranging from the Dalton concept through modern orbital theories and bonding in carbon compounds to nuclear energy in the stars.

On the positive side the numerous illustrations and drawings are good and usually significant. The questions and problems at the end of the chapters contain numerous ones that are thought provoking, and even those that basically involve only conversion factors are phrased so as to require more than blind substitution in formulas.

In summary, this reviewer feels that this book as a text would either be a rather useless review for students who have sufficient background to fit its material into a significant comprehension of nature or present the unprepared student with a lot of material without the development necessary to permit him to see how scientific concepts evolve from experiments and observations. To make a course based on this text significant the instructor would have to fill in a great many gaps by his lectures and probably expand the course beyond a semester. As a reference book it will serve better to stimulate an instructor to develop an integrated course than it will as a source book for the students.

Bionics. Vincent Marteka, J. P. Lippincott Company, Philadelphia, Pa., 1965. Pp. 157. Illustrated. Price $4.25.

Reviewed by: Hugh F. Henry
DePauw University
Greencastle, Indiana

A copy of this book should be in every high school's library—not so much for its technical excellence as

(Continued on page 96)